

The Association Between Greater Continuity of Care and Timely Measles–Mumps–Rubella Vaccination

ABSTRACT

Objectives. This study assessed whether greater continuity of care is associated with timely administration of measles–mumps–rubella (MMR) vaccination.

Methods. We studied 11 233 patients continuously enrolled in Group Health Cooperative (GHC) from birth to 15 months. We used a preestablished index to quantify continuity of care based on the number of primary care providers in relation to the number of clinic visits. MMR vaccination status at 15 months was assessed with automated immunization data systems at GHC.

Results. In a logistic regression model, both medium continuity (odds ratio [OR] = 1.20, 95% confidence interval [CI] = 1.08, 1.33) and high continuity (OR = 1.36, 95% CI = 1.22, 1.52) were associated with increased likelihood of being immunized by 15 months compared with patients in the lowest tercile of continuity of care.

Conclusion. Greater continuity of care is associated with more timely immunization. (*Am J Public Health.* 2000;90:962–965)

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Despite recent advances, underimmunization of US children remains a multifactorial problem.^{1–9} A consistent finding in previous studies of immunization delivery has been that poor access to care is a barrier to achieving timely up-to-date status.^{6,10,11} Access to care is typically defined as having a regular source of medical care; that is, an outpatient setting where one can go to receive ambulatory medical services. However, having a regular *source* of care (i.e., a given clinic) is not equivalent to having a regular *provider* of care (i.e., a specific practitioner). The distinction between continuity of clinic and continuity of provider previously has been made in assessing health outcomes in children.^{12,13}

Although the benefits of continuity of primary provider for pediatric patients remain controversial,^{14–16} we recently found that increased continuity of care is associated with decreased use of emergency services.¹⁷ However, the effects of increased continuity of care on preventive service use remain poorly understood. A recent study found that receipt of immunizations within a “medical home” was associated with an increased up-to-date rate, but the extent to which continuity of care within that home affected rates was not examined.¹⁸ We therefore undertook a study to assess the extent to which continuity of provider within a health system is associated with timely immunization administration. Our hypothesis was that increased continuity of care would be associated with increased up-to-date status for measles–mumps–rubella (MMR) vaccination at 15 months.

Methods

Setting and Providers

Group Health Cooperative (GHC) of Puget Sound is a health maintenance organi-

zation based in Seattle, Wash, with approximately 530 000 members. Its automated database contains comprehensive records of immunizations and outpatient visits (including unique patient and physician identifiers), which allow for assessment of both vaccination coverage and continuity of care for each member.

GHC uses an immunization tracking system and a centralized set of immunization guidelines to assist physicians and parents in managing patients’ vaccination schedules. This system has been in place since 1991 and routinely checks the immunization status of children between 8 and 22 months of age. If a child lags behind in immunizations, the system sends a series of reminders to both the patient’s family and his or her provider so that the child will be brought in to be vaccinated. The GHC immunization registry, which is now being used as part of a large national study, has been shown to be accurate and reliable.¹⁹

All children cared for within GHC are assigned a primary care provider—either a pediatrician or a family physician. No resident teaching clinics were included in our study.

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Patients

Children included in this study were born between January 1, 1993, and August 31, 1997; resided in King, Pierce, Thurston, and Kitsap counties in Washington; and had at least 4 outpatient visits. To ensure complete health care utilization histories, eligible children had to be continuously enrolled in GHC during the first 15 months of life and were excluded if they were on military, non-medical (e.g., dental), or network-model health plans.

Outcome

In accordance with American Academy of Pediatrics guidelines, GHC recommends that the first MMR vaccination be given no later than 15 months of age.²⁰ We chose to focus on MMR vaccination for 2 reasons. First, it is given in the second year of life, thereby allowing time for continuity of care to develop. Second, MMR vaccination is especially important given recent national and regional outbreaks of measles.^{21–23}

Continuity Measure

Our primary predictor variable was continuity of care. Several indexes for measuring continuity of care have been developed.²⁴ As in our previous study, we used the Continuity of Care Index.²⁵

The Continuity of Care Index takes on values between 0 and 1. A value of 0 signifies maximum dispersion, which occurs when a different provider is seen at every visit. A value of 1 signifies minimum dispersion, which occurs when the same provider is seen at every visit. To demonstrate the behavior of the Continuity of Care Index, several hypothetical patterns, each involving 8 visits, are shown in Table 1. Note that as the contacts with providers become more dispersed—from all visits with Provider A to every visit with a different provider—the Continuity of

Care Index moves from 1 to 0. We restricted our analysis of continuity to patients with 4 or more visits to a primary care provider, because meaningful continuity of care can scarcely exist with few visits.

Continuity of care was measured either at the time of MMR vaccine administration or, if no MMR vaccine was given, at the last outpatient visit before 15 months of age. Only visits to primary care providers (general pediatricians and family physicians) were included in calculations of patients' continuities of care; visits to subspecialists were excluded and hence did not affect the values.

Covariates

We included sex and Medicaid status as covariates. In addition, we included year of birth to control for secular trends in immunization rates and total outpatient visits as a continuous variable to ensure that the number of contacts (both well and sick) between the system and the patients did not confound our findings. We did not distinguish between "well" and "sick" visits for 2 reasons. First, this distinction can be difficult to make post hoc, because diagnostic coding can be inaccurate, such as when a child has otitis media during a routinely scheduled examination or when a sick 6-month-old receives immunizations during an acute visit. Second, because the explicit policy of GHC is to seize every opportunity to immunize children, and ill children rarely meet criteria for postponement, the distinction seemed unnecessary.

Statistical Analysis

Logistic regression was used to model the odds that the MMR vaccine was administered by 15 months of age. We also conducted a subgroup analysis of Medicaid children. For all analyses, continuity of care was modeled as terciles based on its distribution in our sample.

Because timely administration of the MMR vaccine is not a rare event at GHC, the

odds ratios derived from our logistic model were converted to relative risks²⁶ to more clearly convey the strength of the association for our main predictor of interest, continuity of care.

Results

There were 11 233 eligible patients, with an average of 12.0 visits per patient. Demographic data on patients, including immunization rates, are presented in Table 2. The mean Continuity of Care Index for patients at 15 months of age was 0.42 (SD=0.25). Terciles were defined as follows: 0 to 0.27=low, 0.28 to 0.50=medium, and 0.51 to 1.0=high.

The unadjusted relative risk for receipt of MMR vaccination by 15 months for all children with medium continuity of care was 1.04, and the risk for those with high continuity of care was 1.06. For Medicaid children, the relative risk associated with medium continuity of care was 1.06 and that associated with high continuity of care was 1.41.

In a multivariate model for all children, medium continuity of care was associated with an increased likelihood of being up-to-date for MMR vaccine at 15 months of age (OR=1.20, 95% confidence interval [CI]=1.08, 1.33), and high continuity of care was associated with an even greater likelihood (OR=1.36, 95% CI=1.22, 1.52). Each additional outpatient visit was associated with an increased likelihood of being up-to-date (OR=1.06, 95% CI=1.05, 1.07), and Medicaid status was associated with a decreased likelihood (OR=0.49, 95% CI=0.43, 0.57). The results for only non-Medicaid children are not meaningfully different from the overall results (Table 3).

We found similar results for the subgroup of 874 Medicaid children. Medium continuity of care was not associated with a significant increase in the likelihood of being up-to-date for MMR vaccine at 15 months of age (OR=1.16, 95% CI=0.83, 1.62) but high

TABLE 1—Example of the Continuity of Care (COC) Index

Visit Sequence ^a	COC Index
AAAAAAA	1
AAAABAAA	0.75
ABAABAAA	0.57
ABAACAAA	0.54
ABCBAEFA	0.23
ABCDEFGH	0

^aEach unique letter denotes a different provider.

TABLE 2—Demographic Data on Study Subjects: Washington State, 1993–1998

	All Children (N=11 233)	Medicaid Children (N=874)
Males	51.6%	51.6%
MMR vaccine by 15 months		
Low COC	71%	54%
Medium COC	74%	57%
High COC	75%	76%
Overall	73%	58%
Mean no. of visits (SD)	12 (5.6)	11.3 (5.8)

Note. MMR = measles–mumps–rubella; COC = continuity of care.

TABLE 3—Logistic Regression Model for Measles–Mumps–Rubella Vaccination by 15 Months: Washington State, 1993–1998

	All Children	Non-Medicaid Children	Medicaid Children
	OR (95% CI)	OR (95% CI)	OR (95% CI)
COC Index			
Low	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
Medium	1.20 (1.08, 1.33)	1.19 (1.07, 1.33)	1.16 (0.83, 1.62)
High	1.36 (1.22, 1.52)	1.35 (1.20, 1.51)	1.63 (1.15, 2.32)
Total outpatient visits	1.06 (1.05, 1.07)	1.05 (1.04, 1.06)	1.08 (1.05, 1.11)
Male	1.03 (0.94, 1.12)	1.03 (0.95, 1.13)	0.96 (0.73, 1.26)
Medicaid	0.49 (0.43, 0.57)	N/A	N/A
Year	1.02 (0.98, 1.06)	1.03 (0.99, 1.07)	0.98 (0.95, 1.12)

Note. OR=odds ratio; CI=confidence interval; COC=continuity of care; N/A=not applicable.

continuity was (OR=1.63, 95% CI=1.15, 2.32) (Table 3).

The adjusted relative risk for all the covariates in Table 3 associated with medium continuity of care was 1.05 (95% CI=1.02, 1.08) for all children and 1.07 (95% CI=0.91, 1.21) for Medicaid children. For children with high continuity of care, the relative risk for all children was 1.08 (95% CI=1.06, 1.11) and for Medicaid children alone was 1.22 (95% CI=1.06, 1.36).

Discussion

We found that increased continuity of care was associated with timely administration of MMR vaccine within a single health care system and that this association was stronger for children on Medicaid. Although the 8% increase in timely MMR vaccination associated with high continuity of care found for all children is modest, the 22% increase found for Medicaid children is considerable. It is important that both of these differences occurred within a single health care system, in which access to and quality of services could otherwise be expected to be uniform and in which baseline immunization rates were good. Although the use of a single system guards against the possibility of other features of care delivery confounding the association between continuity and timely immunization, we cannot say whether this effect would be as strong, stronger, or even weaker in other settings with poor baseline rates.

Increased outpatient visits were associated with an increased likelihood of being up-to-date. This finding suggests that increased contact with GHC by itself improved timely immunization delivery, as one might expect in a system that strives to vaccinate whenever possible. Above and beyond the ef-

fect of increased visits, however, increased continuity of care was associated with still greater rates of vaccination. Of note, the effect of continuity of care appears to follow a “dose–response” relationship, with “high” being associated with a greater likelihood of being up-to-date than “medium.”

The observational nature of this study precludes conclusions about causality. Nevertheless, it is interesting and worthwhile to consider how increased continuity of care might be causally associated with more timely administration of MMR vaccine. There are several possible explanations.

First, increased continuity of care may improve provider–patient rapport, which could make administration of the vaccine more feasible in situations in which parents might otherwise be resistant to it. In other words, the uptake of vaccination might be favorably affected in contexts in which patients and physicians know each other better. This effect might be most pronounced during acute visits that present opportunities to vaccinate, which are frequently missed because of parental resistance.^{5,6,8} Parental compliance with physician recommendations has been shown to increase when those recommendations emanate from a provider identified by parents as their child’s primary one.²⁷ Increased continuity of care may therefore provide a context conducive to more effective and timely immunization delivery.

Second, improved provider–patient rapport could facilitate well-child visits, because parents may be more eager or willing to bring their child to see a provider they feel more bonded to. In this way, the existing reminder system at GHC may act synergistically with continuity of care—a reminder to see a familiar provider for an immunization may have a greater effect than a reminder to see an unfamiliar provider. However, the relationships

between patients and providers must be evaluated from the perspectives of both parties. It is not only parents whose investment in their relationship with a provider may increase as continuity of care increases. Providers have been shown to have greater job satisfaction in situations in which they have greater continuity of care with their patients,²⁸ and it may well be that their investment in their patients²⁹ (their “ownership” of their panels in health maintenance organization parlance) is augmented when they know their patients better. They may therefore take a greater interest in ensuring that vaccinations are expeditiously administered.

One possible noncausal explanation for our findings is that the relationship we found between increased continuity of care and improved immunization delivery was simply a reflection of parental conscientiousness. That is, parents who are more interested in having a regular physician also may be more likely to bring their child for vaccinations in a timely manner. This limitation points to an important implication of our findings. Parents and health care delivery systems must jointly engage in building relationships that optimize patients’ health. It is unlikely that some parents are preordained to fail in establishing a relationship with a regular provider; more likely, this failure represents a preventable or rectifiable disconnect between them and the health care system. To do their part, health care delivery systems must identify patients who are failing to establish a regular provider and must work to ameliorate the situation.

Ettner³⁰ found that reporting a “usual source of care” was not associated with increased use of preventive services by children. Our findings suggest that a “source of care” may be an insufficiently specific measure and that a regular provider may be necessary to build deep enough connections to manifest benefits. Given that every patient in our study, by virtue of belonging to this staff model health maintenance organization, was assigned a primary care provider, why did some patients achieve more continuous relationships than others, and what can be done to improve situations in which continuity of care is poor? Although many managed care plans have an explicit goal that every patient have a primary care physician, simply assigning a provider to a patient may not be enough. More needs to be done to ensure that the de jure primary care provider is the de facto primary one. This study and our previous one¹⁷ suggest that ensuring continuous relationships can pay dividends to patients and health systems alike. Studies of mechanisms by which continuity of care can be monitored and improved are warranted. □

Contributors

D. A. Christakis conceived the research project, designed the study, assisted with the analysis, and wrote the paper. L. Mell assisted in the design of the project, analyzed the data, and contributed to the writing of the paper. J. A. Wright contributed to the writing of the paper. R. Davis contributed to the analysis and to the writing of the paper. F. A. Connell assisted with study design, supervised data analysis, and contributed to the writing of the paper.

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